

Docket No.: 03-01 US

**REMARKS****STATUS SUMMARY**

Claims 1-18 are pending in the present Application. Claims 1-18 are rejected by the Examiner in view of newly discovered reference.

**Claim Rejections – 35 U.S.C. § 103**

Examiner rejects Claim 1 as being unpatentable over Sampath on basis that "Sampath discloses in Fig 5 a method for preprocessing transmit signals comprising limitation of claim 1: "Propagating a reference signal from a receiver site (through a feedback) for obtaining a wavefront of PCV reference signal at a transmitter site", and refers to col. 11, lines 47-50 of Sampath patent. The Applicant respectfully disagrees with the Examiner for the following reasons.

The col.11, lines 47-50 of Sampath patent state the following: *"This embodiment includes the transmitter obtaining a transmission antennae correlation matrix from a receiver 550 in a FDD system, or through direct calculation in a TDD system"*.

The Examiner incorrectly equates the two statements. Though both embodiments comprise transmitters, receivers and antennae, the pre-processing of signals conducted by Sampath and pre-processing of signals described in the claimed invention are entirely different.

Sampath's antennas are real multiple microwave antennas, each antenna incorporating real transmitter and receiver. Signal pre-processing in Sampath's system includes measurement of correlation matrix elements from each one antenna to another. This methodology is equivalent to measurement of correlation matrix elements in the cable of  $n$  twisted pairs (see references to the prior art of our invention: S. Verdu, Multiuser Detection, Cambridge University Press, UK, 1998; G. Ginis and J.M.Cioffi, "Vectored-DMT: A FEXT Canceling Modulation Scheme for Coordinating Users," Proceedings of IEEE International Conference on Communications 2001, Vol. 1, Helsinki, Finland, pp. 305-309, June 2001; J. M.Cioffi, EE 379c textbook, "Digital Transmission Theory, Volume I," <http://www.stanford.edu/class/ee379c/>). Thus, opposing our claims with Sampath's patent is the same as oppose them with our own prior art, except that our prior art is much closer because it teaches correlation matrix not in the system of microwave antennae but in twisted pair cables. From the point

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of view of signal pre-processing, the problems of practical implementation experienced by our prior art and by Sampath, are the same. Here is the citation from our "Background" section: "To determine  $n(n-1)/2$  matrix elements  $W_{ik}$  for  $n$  pairs, equations (3) and (4) should be applied to at least  $(n-1)/2$  vectors  $\mathbf{X}$ , to provide a complete system of linear equations. If  $n=10$ , the system of 45 equations has to be resolved, each matrix element  $W_{ik}$  being expressed as a sum of multiple products of matrix elements  $H_{ik}$  from Eq. (3). Even if the numerical difficulties are resolved the statistical errors in  $H_{ik}$  when transferred into  $W_{ik}$  values will accumulate. For reference purposes,...."

The Phase Conjugation Vectoring (PCV) antenna of the claimed invention is virtual and relates to a physical model. In reality, no antenna exists in the multi-pair transmission system, and the technical content of the invention would not change if the term "antenna" is changed to "plurality of transmitters". The essence of the claimed invention is to simplify and to radically improve accuracy of signal pre-processing applying physical phenomena of phase conjugation to signal transmission in telephone cable. This physical phenomena comprising INVERSION of amplitudes and phases of plurality of signals at the transmission end to FOCUS all these signals to ONE twisted pair at the receiving end (nothing like that is done in Sampath's patent or in any other cited prior art).

Again, the essence of claimed invention is to substitute complicated calculations of matrix elements (Sampath AND/OR our prior art) by simple summation of complex amplitudes (please see the Detailed Description of the subject patent applicaiton).

Next Examiner's arguments regarding Claim 1 is that "establishing PCV antenna bundle for each twisted pair of said plurality" is equivalent to Sampath's col. 11, lines 51-54: "*The preprocessor 20 receives multiple (B) inputs from the space/time processor 510. The space/time processor can more specifically be a transmitter diversity processor that generates multiple (B) inputs. The embodiment can be ....*" Please note that signal pre-processing described by Sampath is nothing else but calculation of correlation matrix elements, entirely different from phase conjugated approach and summation of complex amplitudes.

Further Examiner's argument is that "scaling input transmission signals by said PCV reference signal for obtaining mutually coherent PCV transmission signals" is the same as Sampath (col. 12, lines 10-14) "*A scaling matrix (P) is generated based upon system implementation issues, such as available transmit power, BER/SNR requirements, modulation order and the minimum distance error matrix. Finally, the precoder matrix (F) is calculated as  $F=O^*P^*O\_error$* ". There is

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nothing common between simple amplitude scaling fulfilling phase conjugation requirements of our patent, and Sampath scaling related to a complex issue of BER/SNR requirements.

Further Examiner's argument that "propagating said mutually coherent PCV transmission signals via said PCV antenna bundles for receiving only one signal in a corresponding twisted pair at the receiver site" is the same as Sampath (col. 12, lines 15-18) "*the preprocessor provides for transmission of the B coded symbol streams over the B strongest eigenvectors of the antennae correlation matrix improving the SNR of the transmitted symbol streams*" belongs to the same category: the way how the signal is pre-processed does not include phase conjugation but requires calculation of matrix elements.

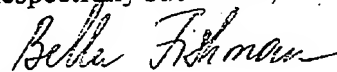
The Applicant respectfully submits that the rejections of other claims as being unpatentable over Sampath, Miyoshi, Cioffi; Sands or Amrany in any combinations thereof are not proper for the reasons disclosed above. The Examiner consistently neglects the new and advantageous features brought to signal pre-processing by phase conjugation. As described in the subject patent application, for any appreciable number of pairs  $n \gg 1$ , reliable definition of matrix elements is problematic, and the purpose of the invention is to simplify and increase accuracy of creating and solving the matrix equation in the prior art by introducing a "plurality of bundles of said selected twisted pairs for creating a corresponding plurality of phase conjugated vectoring antennas (PCV)".

#### CONCLUSION

It is respectfully submitted that the present application is in condition for allowance, and an early notice to such effect is earnestly solicited. If the Examiner has any questions concerning the communication, or would like to discuss the art, or specifics of phase conjugation and its difference from other ways of characterizing random media she is invited to contact the undersigned agent at (650) 856-3571.

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Respectfully submitted,



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